

# **Exozodiacal Dust (aka. Debris Disks)**

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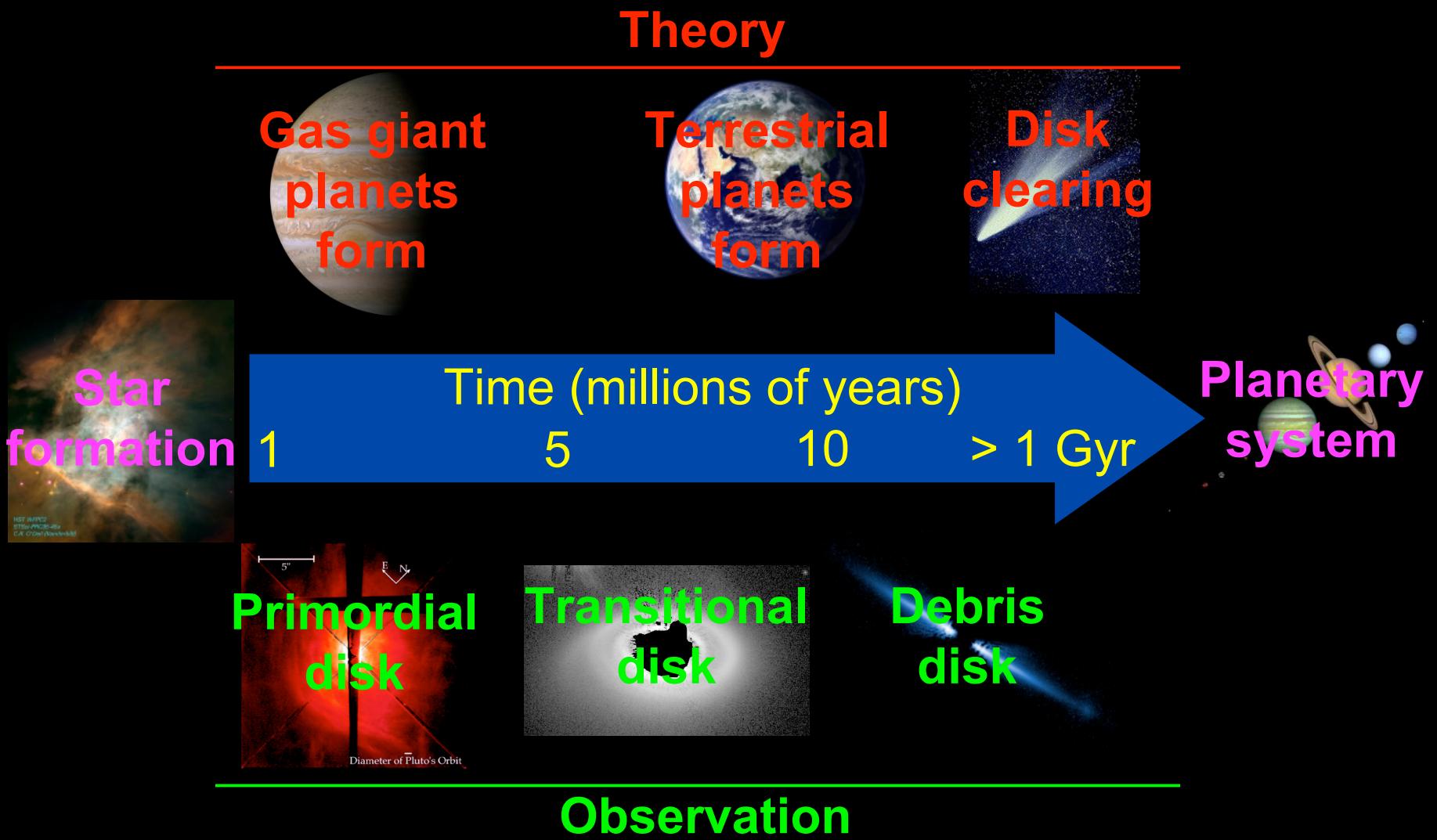
Exozodiacal Dust (aka. Debris Disks)

# Outline

- Science introduction – Aki Roberge
- Spitzer results – Geoff Bryden
- Theory – Chris Stark
- Break
- Scattered light imaging – Marshall Perrin
- Keck I results & plans – Rachel Akeson
- LBTI plans – Phil Hinz
- Recommendations – Phil Hinz & Rafael Milan-Gabet

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# Theoretical & Observational Timelines

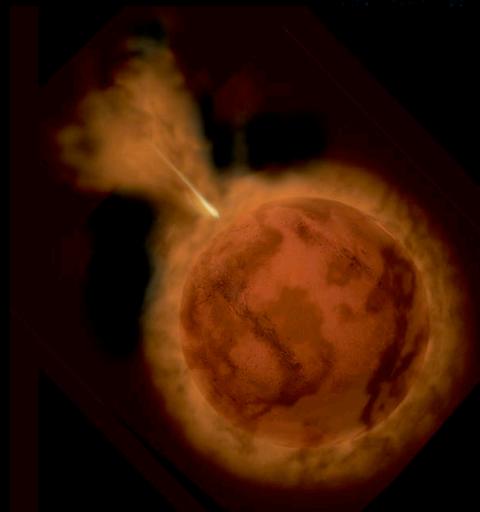


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# Debris Disks

- Wide range of ages :  
~ 10 Myr to few Gyr
- Optically thin disks
  - Short dust lifetimes
- Secondary material (not primordial)
- Delivery of volatiles to terrestrial planet surfaces  
(e.g. Morbidelli et al. 2000)

AU Mic — 12 Myr  
Krist et al. (2004)

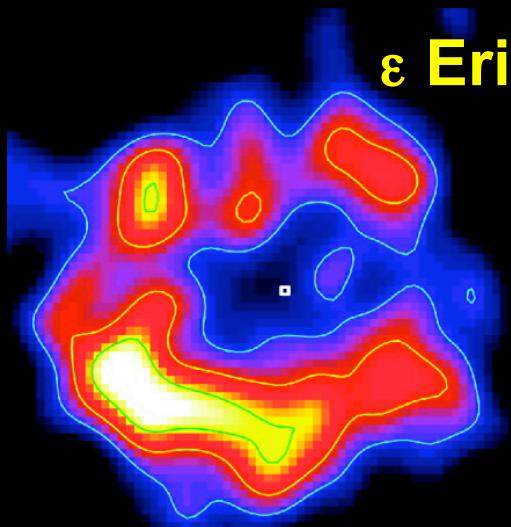


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# Dust Structures

Clumps

$\varepsilon$  Eridani @ 850  $\mu$ m

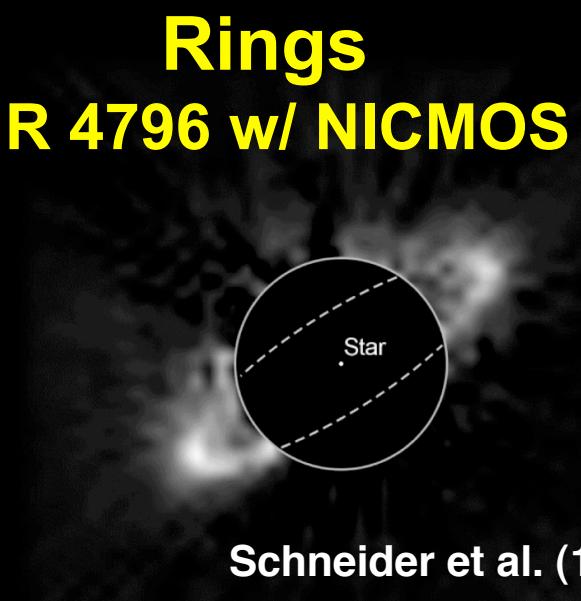


Greaves et al. (2005)

Rings

HR 4796 w/ NICMOS

Caused by  
unseen  
planets ?

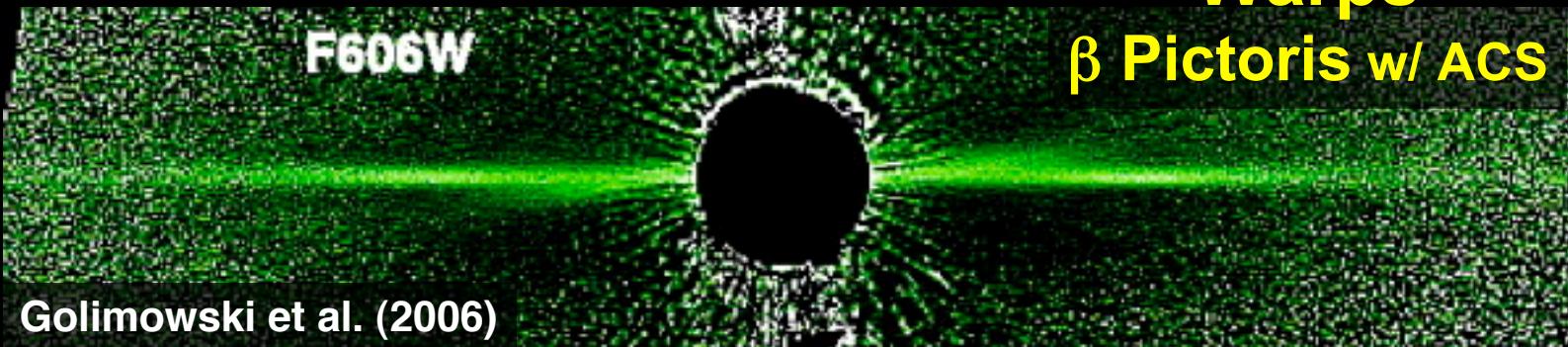


Schneider et al. (1999)

Warps

$\beta$  Pictoris w/ ACS

F606W



Golimowski et al. (2006)

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# Debris Disks as Exozodis

- Sun has a debris disk
  - Zodiacal dust comes from asteroids, comets
- Solar System now : 1 zodi
  - $L_{\text{IR}}/L_{\text{star}} = 10^{-7}$  for dust interior to asteroid belt
  - Beta Pic :  $\sim 10,000$  zodis
- Solar System over 100 Myr : 0.5 – 2 zodis

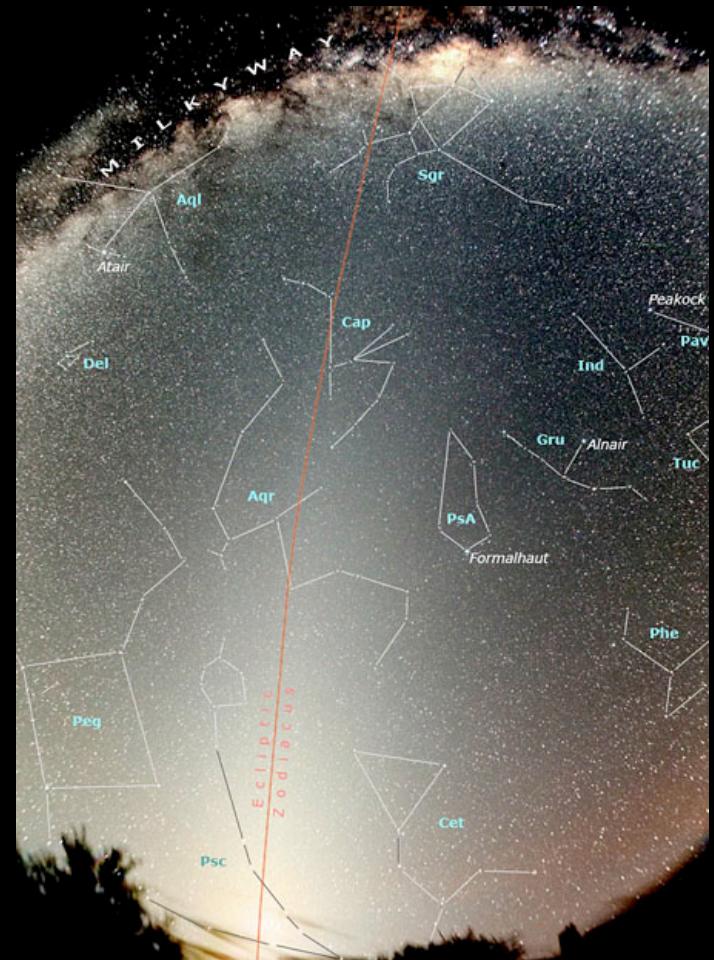
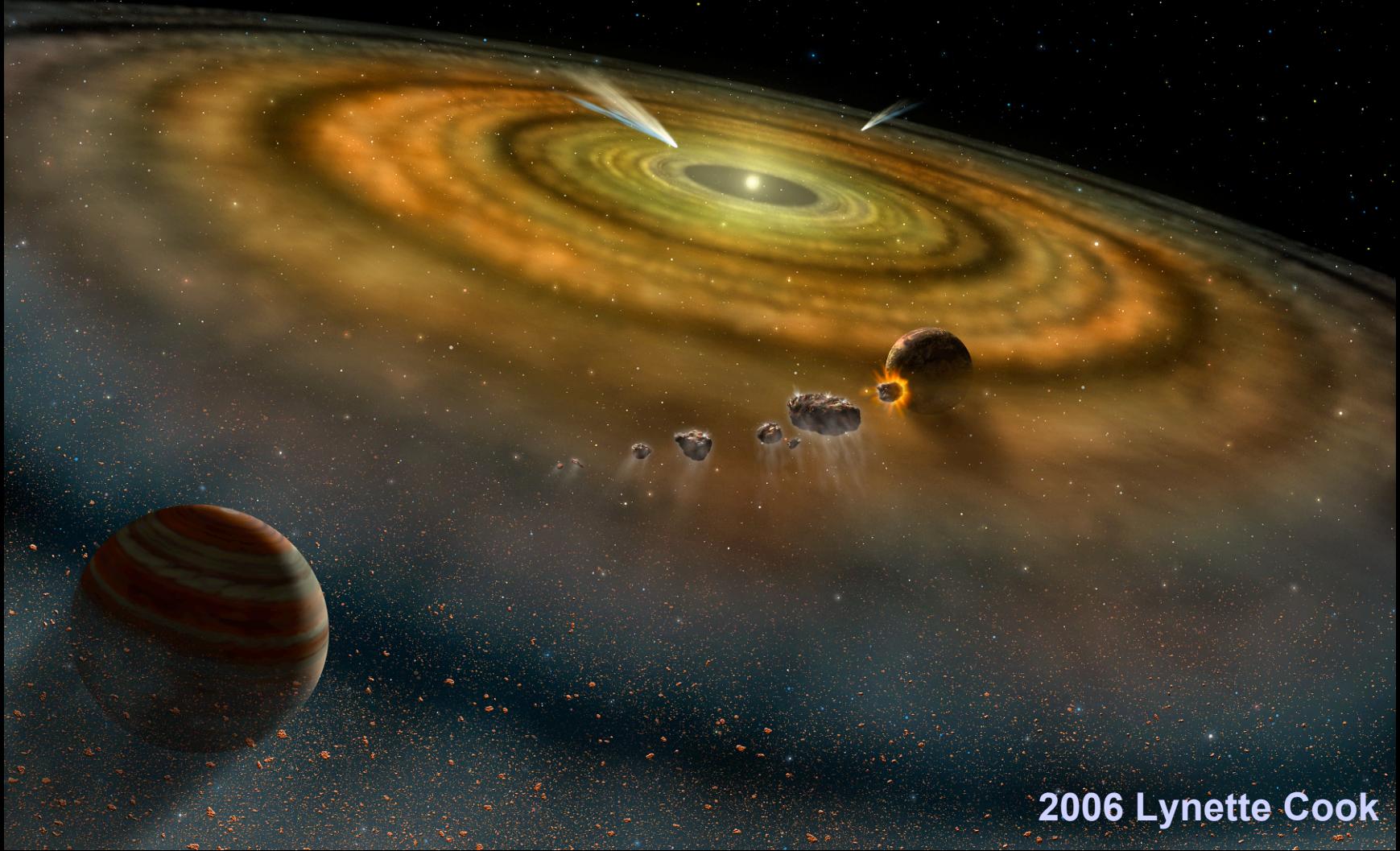


Image credit: Stefan Seip

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# Exozodi Brightness

- Light scattered off exozodi dust mixes into planet images and spectra
- Detection time  $\propto$  exozodi brightness
  - Plus facility resolution, sensitivity, contrast
- TPF-C STDT report
  - 2004 : < 10 zodis ; 2006 : assumed 3 zodis
- Give generic formula and calculate for different architectures [ time  $\propto D^{-4}$  ]



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